V2.2 Connection plan

18.09.2023

V2.2 summary:
- single board
- 1x sabertooth 2x60A driver
- modified board 'motorctl' from V2.1

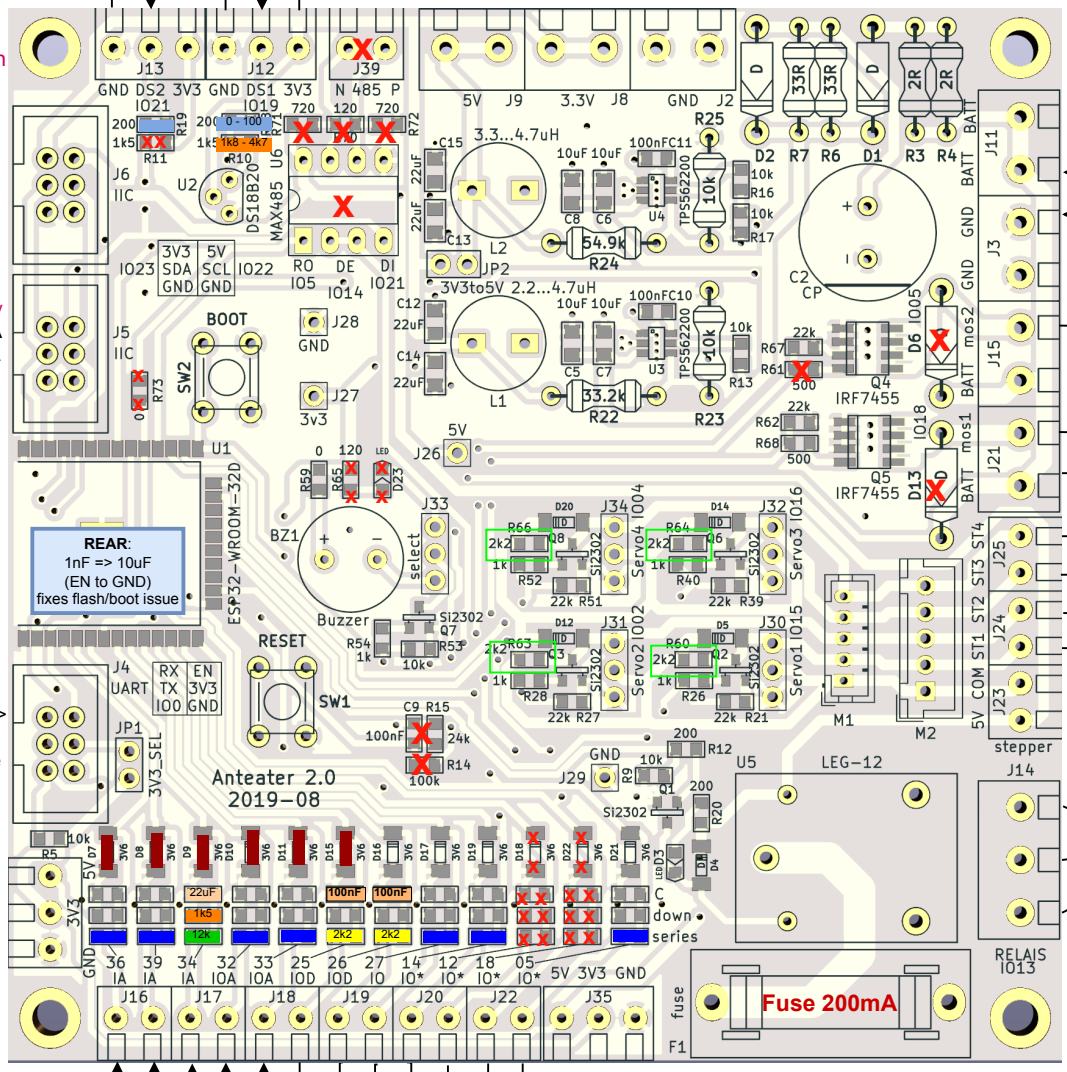
Button in housing for standalone operation

gpio19: 3x ds18b20 OWB bus temp sensors (driver, motors)

gpio21: UI: Button

UI: Display
IO23: SDA
IO22: SCL
3V3
GND

UART<=> USB for firmware upload



← 12V from stepdown/fuse
← GND from stepdown
→ [disabled]
→ **FREE**
→ 12V to Relay COM
→ gpio 04: **FREE**
→ gpio 16: **FREE**
→ gpio 02: **FREE**
→ gpio 15: **FREE**
=> control 4x relay for chair adjustment in future

gpio13: Relay
→ NC
→ COM 12V ("Batt" / stepdown)
→ NO driver: 12V fan

cable configuration

control-box => driver-box

Oelflex 12x0.5

gn: GND (driver)
01. 5V (reserve)
02: 3V3

03: RX/S1 Sabertooth driver
04: S2 Sabertooth driver (reserve)

05: current-sensor left
06: current-sensor right

07: fan 12v from relay
08: ds18b20 owb

09: GND (current-, ds18b29-sensors)
10: GND (reserve)
11: GND (reserve)

optical-sensor axle => control-box

2 cables (one for each axle):
Oelflex 5x0.5

gn: GND
01: 3V3 [unused]
02: 5V
03: Sensor out (drain) / pulses
04: [unused]
05: [unused]

control-box => UI-arm

D-Sub 9 pin

green: GND
red: 3V3

brown: Joystick X
purple: Joystick Y

yellow: encoder A
blue: encoder B
black: encoder switch

gray: display SDA
orange: display SDC

Joystick pinout

JST connector 5 pin

(pins stick order left to right)

red: VCC (3V3)
orange: GND
brown: X (analog 0-3V)
white: n.c.
black: Y (analog 0-3V)

driver configuration

DIP switches:
"simplified serial, 9600 Baud"
101011 (1=up)

Legend pcb

- 0 Ohm Resistor
- 3v3 Z-Diode
- 0 Ohm Optional
- [xxx] Conflicting Component
- xx nopop

V2.2 Wiring-plan

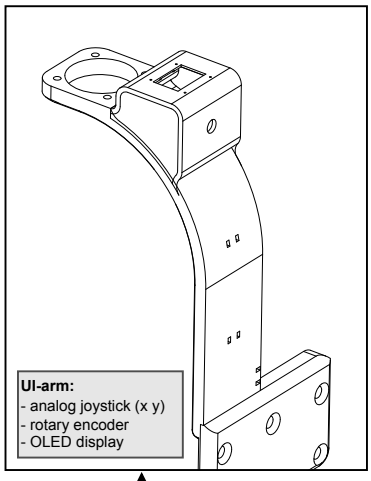
18.09.2023

Li-ion Battery
Samsung INR18650-35E 3500mAh 3,7V
7S 15P
150A BMS

120A connector

Main power switch

charging port
(50A connector)



UI-arm:
- analog joystick (x y)
- rotary encoder
- OLED display

Fuse box

50A connector

armchair:
- control box for electric-adjustment
- power outlet e.g. USB Charger

2x2.5mm2
24V (2A fuse)

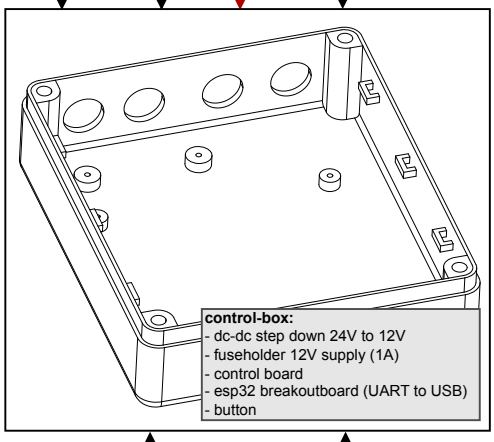
USB Cable
(firmware upload)

9 pin SUB-D connector

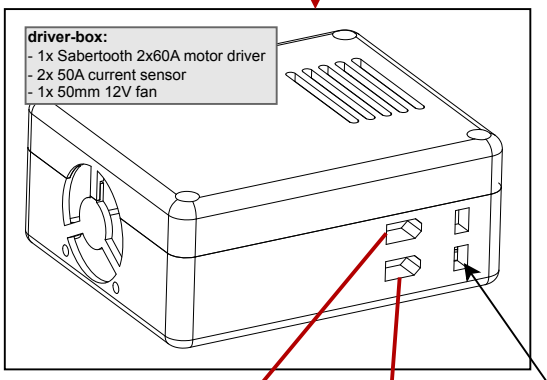
1x10mm2 GND
1x10mm2 24V (2x40A fuse)

12x0.5mm2

Control driver
via RS232
(1 pin)



control-box:
- dc-dc step down 24V to 12V
- fuseholder 12V supply (1A)
- control board
- esp32 breakoutboard (UART to USB)
- button



driver-box:
- 1x Sabertooth 2x60A motor driver
- 2x 50A current sensor
- 1x 50mm 12V fan

5x0.5mm2

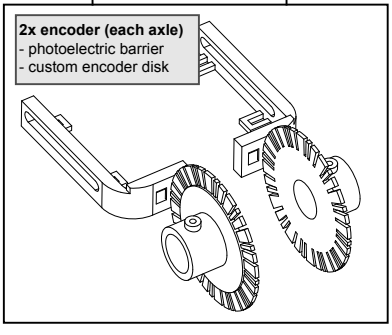
5x0.5mm2

Motor left

Motor right

2x temperature sensor motor
red: 3V3
black: GND
yellow: owb

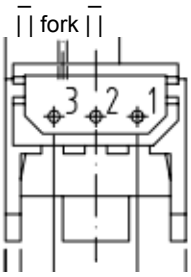
Note: inverted direction of right motor already accounted in the driver box
=> motors with connectors are interchangeable



2x encoder (each axle)
- photoelectric barrier
- custom encoder disk

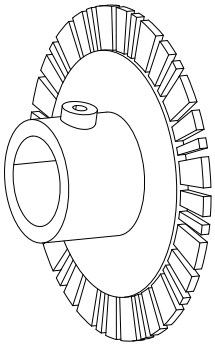
measure rotational speed + direction

Transmissive Optical Sensor
TCYS5201



1: GND
2: out
- low when not interrupted
- floating when interrupted
=> pullup needed
3: (2.9V) - 5.5V

optical-sensor axle => control-box
2 cables (one for each axle): **Oelflex 5x0.5** gn: GND 01: 3V3 [unused] 02: 5V 03: Sensor out (drain) 04: [unused] 05: [unused]



Custom Encoder disk
mounted on each Axle

To be able to detect the direction of rotation the disk has 12 groups of segments with 3 different lengths (ratio 1:2:3) with a constant gap between each segment

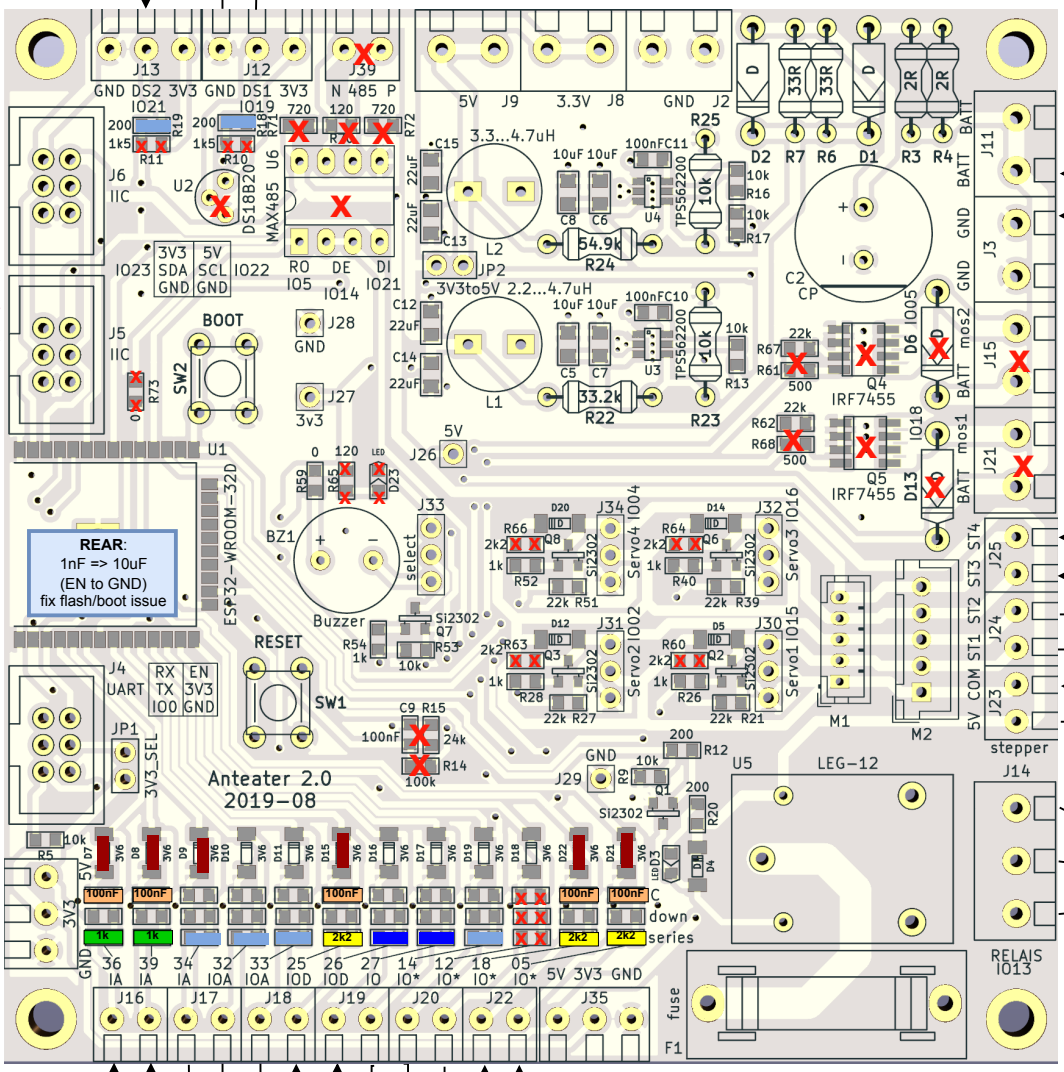
V2.1 Board 1: control

07.09.2023 [dropped]

UART => motorctl pcb
IO21:RX - IO19:TX - GND

V2.1 summary:
- two boards
- 2x HC240A driver
- brake resistors
- UART communication

=> dropped due to driver change



UI: Display
IO23: SDA
IO22: SCL
3V3
GND

UART<=>
USB for
firmware
upload

UI: Display
3V3
GND

12V from pcb motorctl
GND from pcb motorctl

gpio 04: **FREE**
gpio 16: **FREE**
gpio 02: **FREE**
gpio 15: **FREE**
5V (signal pullup)

gpio13 Relay
NC:
COM: **FREE**
NO:

note: esp32 internal
pullup = 10k - 100k

gpio 36: ADC UI: Joystick Y
gpio 39: ADC UI: Joystick X
gpio 34: ADC **FREE**
gpio 32: ADC **FREE**
gpio 33: ADC **FREE GPS?**
gpio 25: UI: encoder switch
gpio 26: UI: Display SCL
gpio 27: UI: Display SDA
gpio 14: [RS485] **FREE**
gpio 12: [LED/BUZZER]
gpio 18: [MOS1] UI: encoder B
gpio 05: [MOS2] UI: encoder A

Legend pcb

- 0 Ohm Resistor
- 3v3 Z-Diode
- 0 Ohm Optional

[xxx] Conflicting Component
xx nopop

cable configuration

control-box => UI-arm

D-Sub 9 pin

green: GND
red: 3V3

brown: Joystick X
purple: Joystick Y

yellow: encoder A
blue: encoder B
black: encoder switch

gray: display SDA
orange: display SDC

Joystick pinout

JST connector 5 pin
(pins stick order left to right)

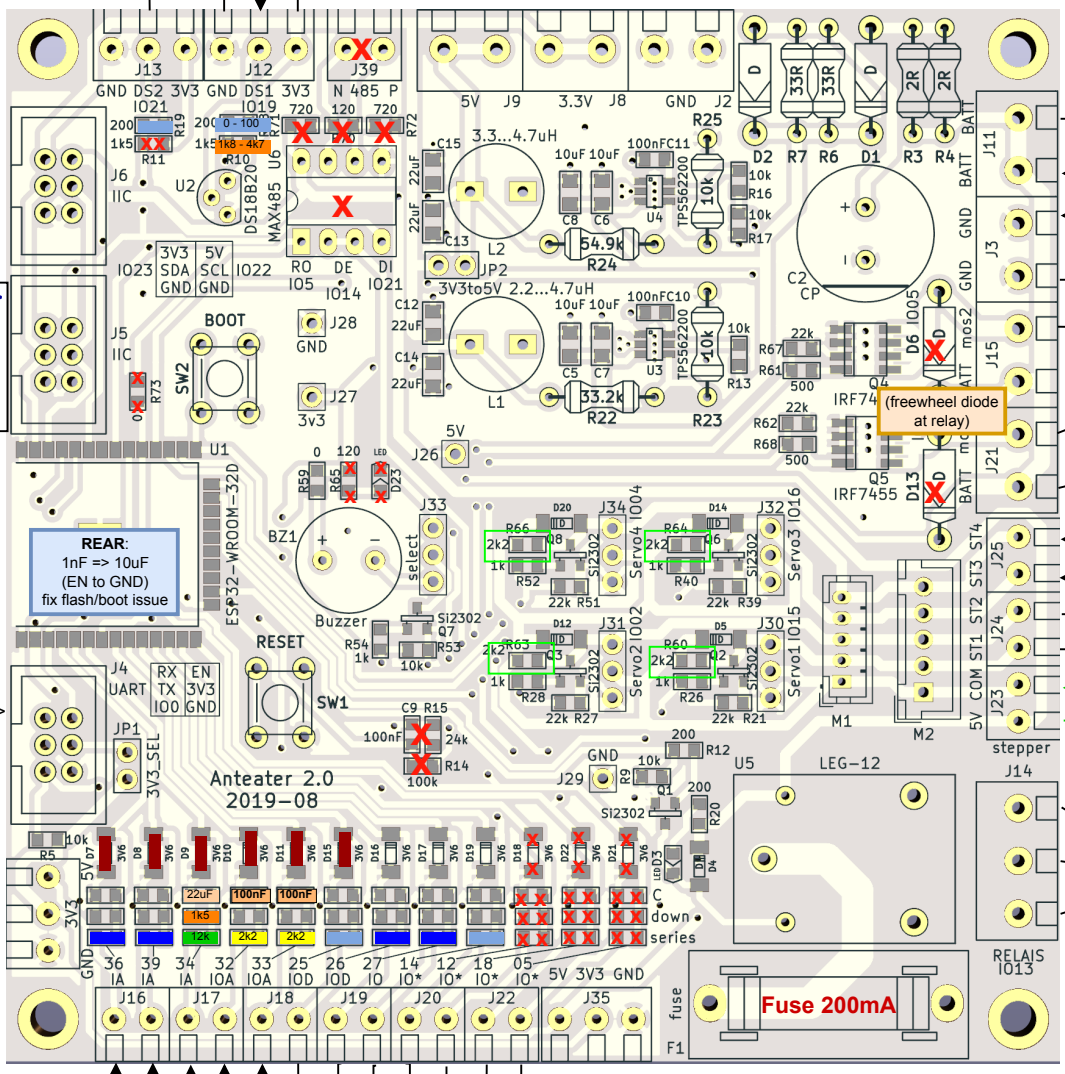
red: VCC (3V3)
orange: GND
brown: X (analog 0-3V)
white: n.c.
black: Y (analog 0-3V)

V2.1 Board 2: motorcontrol

07.09.2023 [dropped]

gpio19: 6x ds18b20
OWB bus temp sensors
(drivers, motors, brakes)

gpio21: **FREE**



gpio 36: ADC driver: Current sensor motor-left
gpio 39: ADC driver: Current sensor motor-right
gpio 34: ADC Battery voltage (stepdown) [29.4 -> 3.27V]
gpio 32: ADC encoder left axle
gpio 33: ADC encoder right axle
gpio 25: FREE
gpio 26: driver: motor-left PWM
gpio 27: driver: motor-right PWM
gpio 14: [RS485]
gpio 12: [LED/BUZZER]
gpio 18: [MOS1] [brake relay right]
gpio 05: [MOS2] [brake relay left]

Legend pcb

- 0 Ohm Resistor
- 3v3 Z-Diode
- 0 Ohm Optional

[xxx] Conflicting Component
xx nopop

cable configuration

control-box => driver-box

Oelflex 12x0.5

gn: GND
~~01: 5V~~
01: 3V3

02: bridge-left A
03: bridge-left B
04: bridge-left PWM

05: bridge-right A
06: bridge-right B
07: bridge-right PWM

08: current-sensor left
09: current-sensor right

10: fan 12v from relay
11: ds18b20 owb

optical-sensor axle => control-box

2 cables (one for each axle):
Oelflex 5x0.5

gn: GND
01: 3V3 [unused]
02: 5V
03: Sensor out (drain) / pulses
04: [unused]
05: [unused]

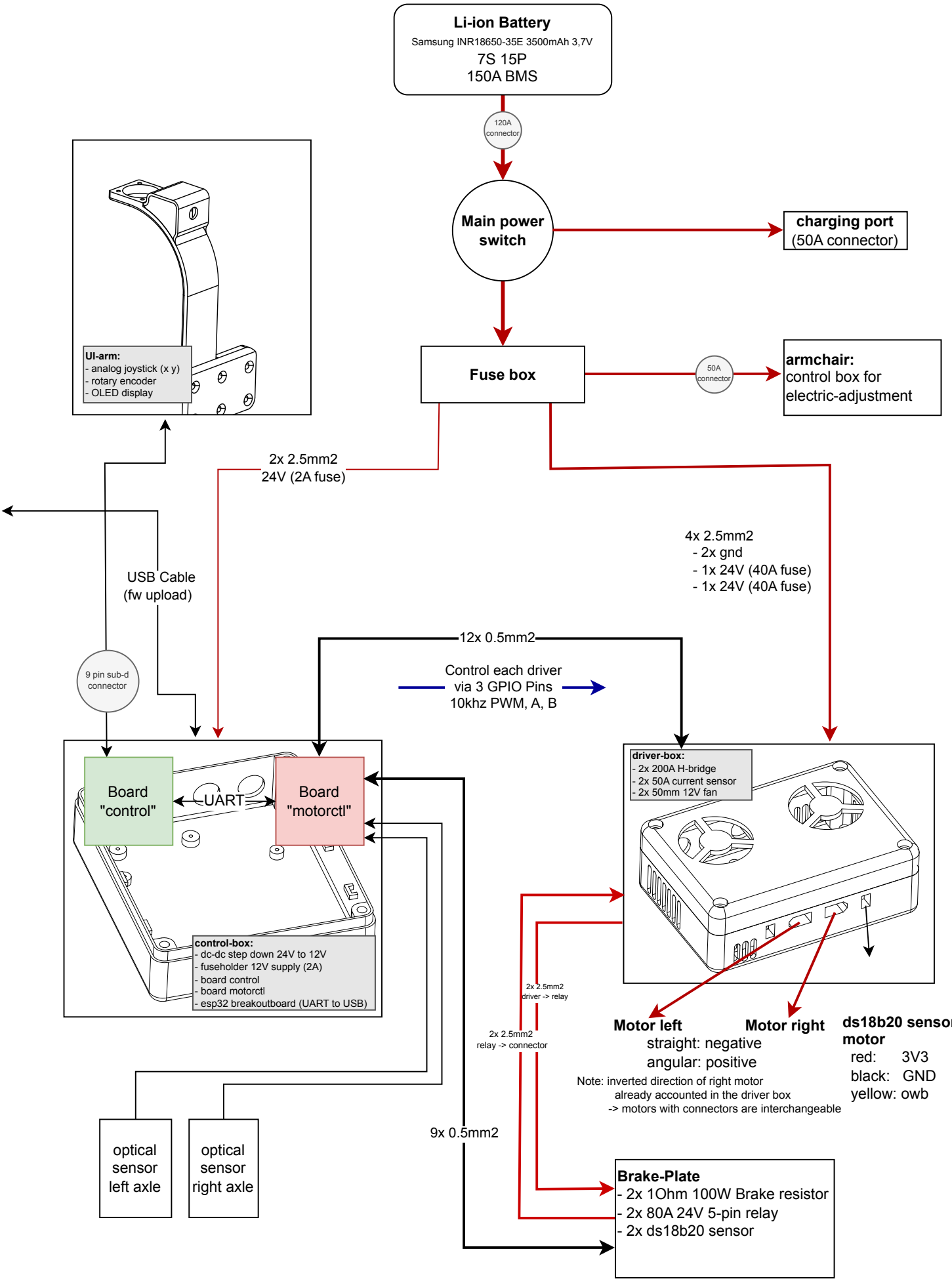
control-box => Brake Relays

Oelflex 9x0.5

gn: GND
01: 3V3 (temp sensors)
02: 24V (BATT -> relays)
03: Brake Relay left (MOS / GND)
04: Brake Relay right (MOS / GND)
05: ds18b20 OWB resistors

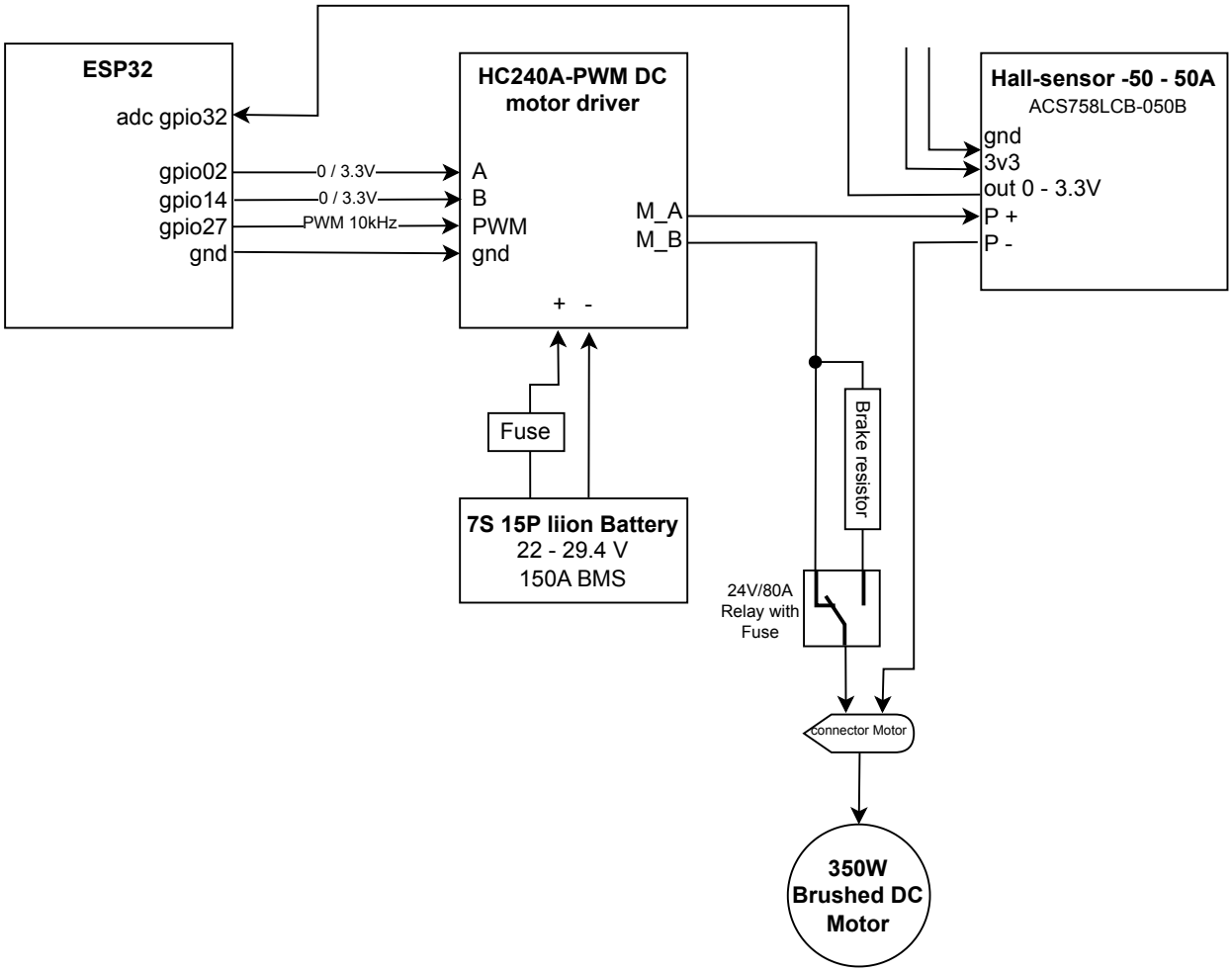
V2.1 Wiring-plan (2 boards)

07.09.2023 [dropped]



V2.1 Driver box overview

07.09.2023 [dropped]



V2.0 Connection plan (single board)

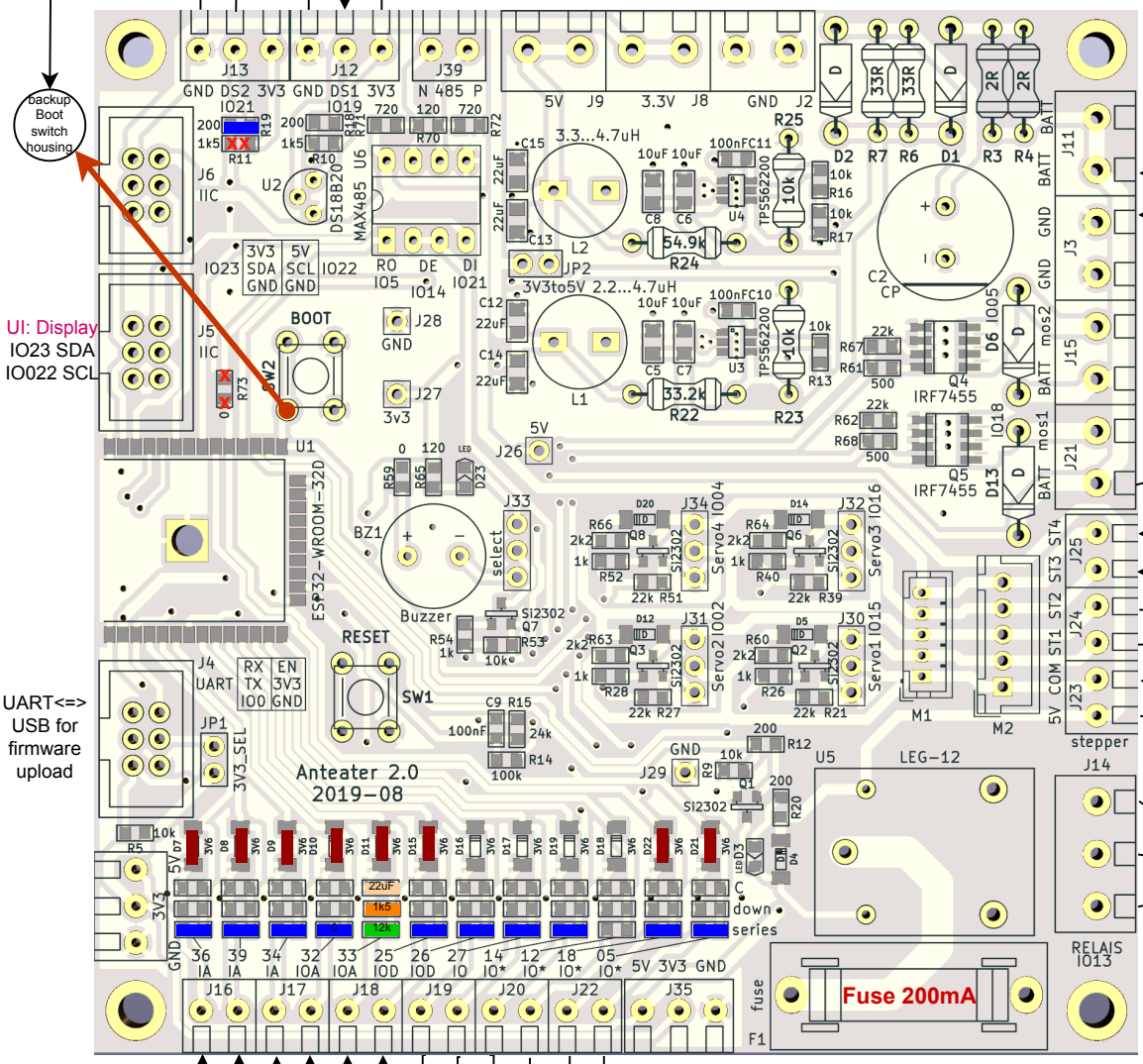
22.08.2023 [dropped]

gpio19: 4x ds18b20
OWB bus temp sensors
(drivers, motors)

gpio21: **FREE**

V2.0 summary:
- amost the same as V1.0
  with a few additions
- 2x HC240A driver

=> dropped due to
pin limitation



gpio 36: ADC UI: Joystick Y
gpio 39: ADC UI: Joystick X
gpio 34: ADC driver: Current sensor motor-left
gpio 32: ADC driver: Current sensor motor-right
gpio 33: ADC Battery voltage (stepdown) [29.4 -> 3.27V]
gpio 25: UI: encoder switch
gpio 26: driver: motor-left PWM
gpio 27: driver: motor-right PWM
gpio 14: [RS485] driver: motor-right B
gpio 12: [LED/BUZZER]
gpio 18: [MOS1] UI: encoder B
gpio 05: [MOS2] UI: encoder A

cable configuration

control-box => driver-box

Oelflex 12x0.5

gn: GND
~~01: 5V~~
01: 3V3

02: bridge-left A
03: bridge-left B
04: bridge-left PWM

05: bridge-right A
06: bridge-right B
07: bridge-right PWM

08: current-sensor left
09: current-sensor right

10: fan 12v from relay
11: ds18b20 owb

control-box => UI-arm

D-Sub 9 pin

green: GND
red: 3V3

brown: Joystick X
purple: Joystick Y

yellow: encoder A
blue: encoder B
black: encoder switch

gray: display SDA
orange: display SDC

Joystick pinout

JST connector 5 pin
(pins stick order left to right)

red: VCC (3V3)
orange: GND
brown: X (analog 0-3V)
white: n.c.
black: Y (analog 0-3V)

Legend pcb

- 0 Ohm Resistor
- 1.5k Ohm Resistor
- 3v3 Z-Diode
- 12k Ohm Resistor
- 1k5 Ohm Resistor

[xxx] Conflicting Component
xx nopop

V2.0 Wiring-plan (single board)

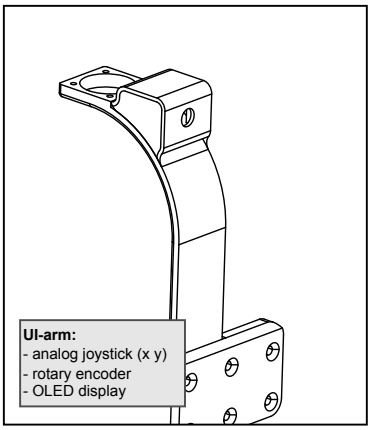
22.08.2023 [dropped]

Li-ion Battery
Samsung INR18650-35E 3500mAh 3,7V
7S 15P
150A BMS

120A connector

Main power switch

charging port
(50A connector)



UI-arm:
- analog joystick (x y)
- rotary encoder
- OLED display

Fuse box

50A connector

armchair:
control box for electric-adjustment

2x 2.5mm2
24V (2A fuse)

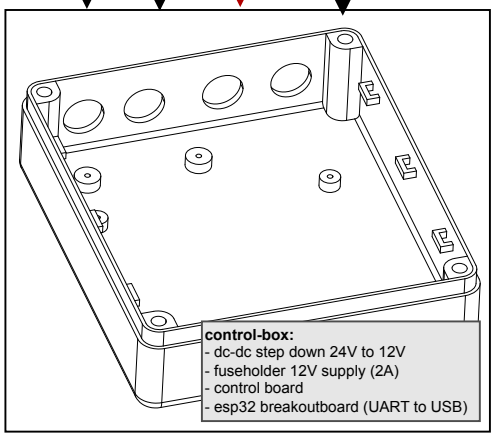
4x 2.5mm2
- 2x gnd
- 1x 24V (40A fuse)
- 1x 24V (40A fuse)

USB Cable
(firmware upload)

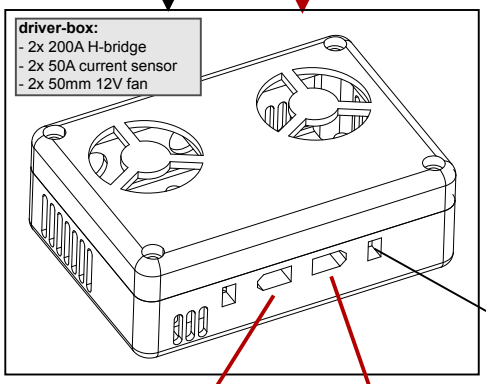
9 pin sub-d connector

12x 0.5mm2

Control each driver
via 3 GPIO Pins
10khz PWM, A, B



control-box:
- dc-dc step down 24V to 12V
- fuseholder 12V supply (2A)
- control board
- esp32 breakoutboard (UART to USB)



driver-box:
- 2x 200A H-bridge
- 2x 50A current sensor
- 2x 50mm 12V fan

ds18b20 sensor motor
red: 3V3
black: GND
yellow: owb

Motor left
Motor right
straight: negative
angular: positive

Note: inverted direction of right motor
already accounted in the driver box
-> motors with connectors are interchangeable